The Context: Journal of English Studies
Volume 12, Issue 4, July 2025
ISSN: 2349-4948 | Impact Factor 4.67
Available at: www.thecontext.in

Article

Advancing ChatGPT for Pedagogical Innovation in Cambodia: Insight from Global Evidence and Local Implications

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Accepted version published on 5th July 2025

DOI https://doi.org/10.5281/zenodo.15806972

Abstract: This study examines the impact of ChatGPT on global educational change and its potential application in Cambodia's evolving education system. Leveraging an integrated narrative synthesis of publications released since 2020, this study examines how generative artificial intelligence, particularly ChatGPT, facilitates instructional innovation, learner engagement, and inclusive education. Better lesson preparation, individualized instruction, and critical thinking are some of the important educational advantages highlighted, while over-reliance, academic dishonesty, and equality issues are some of the hazards addressed. This conversation situates these results within the context of Cambodia, highlighting infrastructure constraints, teacher preparation deficits, curriculum rigidity, and linguistic and cultural challenges. The overview advocates for a regionally tailored AI integration plan, citing the importance of national legislative frameworks, teacher innovation centres, and participatory research on Khmer-language AI technologies. It finds that, with equitable infrastructure and culturally relevant methods, ChatGPT has the potential to catalyse a shift to reflective, learner-centred teaching in Cambodian classrooms.

Keywords: ChatGPT; AI in education; Cambodia; pedagogical innovation; digital equity; teacher capacity; inclusive learning

ISSN 2349-4948

I. Introduction

The advent of generative artificial intelligence (AI), huge language models (LLMs), has dramatically transformed educational discourse, tools, and methodologies. Among these, OpenAI's ChatGPT has emerged as a groundbreaking platform since its release in late 2022, gaining rapid traction for its capacity to simulate human-like interaction, generate structured text, and support a wide range of academic and creative tasks. (Wan et al.). Built on the GPT-3.5 and later GPT-4 architecture, ChatGPT can engage in context-aware conversations, compose essays, offer coding solutions, and explain complex concepts, abilities that educators and students have swiftly begun to explore and integrate into classroom contexts. (Zhai; Dwivedi et al.). The educational impact of ChatGPT has been significant in fostering a shift from traditional content delivery models to more dynamic, inquiry-based, and student-centred pedagogies. Teachers are increasingly leveraging ChatGPT as a co-teacher or instructional assistant, helping to generate lesson plans, personalize feedback, and facilitate differentiated instruction. (Kasneci et al.). Moreover, learners use the tool for brainstorming, clarifying concepts, and simulating Socratic dialogue, enhancing both engagement and autonomy. (Huot and Em "Integrating English Language Teaching with Environmental Sustainability: A Comprehensive Review of Pedagogical Strategies and Global Impacts"). This shift reflects a broader trend in 21st-century pedagogy that emphasizes constructivist and connectivist approaches, where knowledge is co-constructed through interaction with digital tools and networks. (Siemens; Vygotsky). Nonetheless, while generative AI holds the promise of democratizing access to learning support and innovation, it also introduces new pedagogical, ethical, and cultural dilemmas, particularly in contexts with limited digital literacy, infrastructure, or regulatory clarity (Smutny and Schreiberova).

Cambodia has begun to recognize the transformative potential of digital tools in education, as reflected in the Ministry of Education, Youth and Sport's "Policy Guidelines on ICTs in Education" (2020–2028). This policy outlines a national vision for integrating ICTs into teaching, learning, assessment, and school administration, particularly in the wake of disruptions caused by the COVID-19 pandemic (MoEYS). It emphasizes four priority areas: strengthening digital infrastructure, enhancing digital content, expanding teacher digital capacity, and increasing equitable access to online education. However, significant challenges remain in the practical realization of this vision. The digital divide is a critical issue: while urban centers like Phnom Penh and Siem Reap see increased access to devices and connectivity, rural provinces continue to face limited bandwidth, unstable electricity, and a lack of technological infrastructure (UNESCO; OECD). In 2021, a national survey found that only 32% of students in rural secondary schools had consistent internet access, and less than 40% of teachers had received formal ICT training (APO). Furthermore, limited integration of AI or advanced EdTech tools in teacher training programs has left many educators unprepared for the pedagogical implications of AI adoption (Huot and Em, "Integrating English Language Teaching with Environmental Sustainability: A Comprehensive Review of Pedagogical Strategies and Global Impacts"). The integration of generative AI tools such as ChatGPT within this context, therefore, requires not only infrastructure upgrades but also

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strategic interventions in curriculum reform, digital pedagogy, and teacher capacity building.

This critical appraisal aims to provide a comprehensive synthesis of emerging global evidence on the pedagogical impact of ChatGPT and similar generative AI tools in education, with a particular focus on their applications in instructional design, learner engagement, and the development of critical thinking. It seeks to bridge the gap between global innovations and the Cambodian educational reality by examining how these tools can be ethically, effectively, and equitably adapted to support national education reform goals. Specifically, the review will (1) analyse international case studies and research findings on ChatGPT's use in diverse educational settings, (2) evaluate the adaptability of these pedagogical models within Cambodia's socio-technical and linguistic environment, and (3) propose context-sensitive frameworks and guidelines for the integration of ChatGPT into Cambodian schools and universities, focusing on inclusivity, cultural responsiveness, and ethical digital citizenship. Through this, the review aims to contribute to policy discourse, institutional planning, and grassroots-level innovation, offering insights to MoEYS officials, curriculum developers, teacher educators, and EdTech partners.

II. Literature Review: ChatGPT and Pedagogical Innovation: A Global Synthesis

2.1 Theoretical anchors

The integration of ChatGPT and similar large language models into educational settings can be situated within several pedagogical frameworks that emphasize learner-centred, digitally mediated knowledge construction. Constructivist and Connectivist Pedagogies form the foundational theories guiding AI-enhanced learning. Constructivism, grounded in the works of Piaget and Vygotsky, posits that learners actively construct knowledge through experience and social interaction. In digital education, this translates into the use of tools like ChatGPT to support exploration, problem-solving, and inquiry-based learning. Meanwhile, Connectivism, introduced by Siemens, emphasizes the role of digital networks and technological tools in the creation and dissemination of knowledge. Generative AI aligns well with this theory by acting as both a node of knowledge and a facilitator of networked learning, allowing learners to co-construct understanding through interactive dialogue with the model (Mangaroska and Giannakos). The Technological Pedagogical Content Knowledge (TPACK) framework, developed by Mishra and Koehler, provides a comprehensive model for understanding how educators integrate technology into their teaching practices. This framework emphasizes the intersection of three core knowledge domains: content, pedagogy, and technology. Furthermore, the Substitution, Augmentation, Modification, Redefinition (SAMR) model, developed by R. S. Novak, not Aprinaldi, Widiaty, and Abdullah, also guides educators in scaling technological use from simple enhancement to transformational learning experiences. Bloom's Digital Taxonomy, as explored by Amin and Mirza and Anderson and Krathwohl, helps map ChatGPT's role across cognitive domains, ranging from basic recall to higher-order skills such as analysing, evaluating, and creating. For instance, students can engage ChatGPT

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to evaluate arguments, generate thesis statements, or simulate peer reviews, thereby activating analytical and creative cognitive functions.

2.2 ChatGPT in the global classroom

Since its launch, ChatGPT has been adopted across diverse educational environments, from K–12 classrooms to higher education institutions, where it functions as a generative assistant, tutor, and cognitive partner. In curriculum co-design and lesson planning, teachers have used ChatGPT to generate teaching materials, suggest differentiated instructional strategies, and develop assessments aligned with learning outcomes (Kasneci et al.). For instance, in language arts, teachers can prompt ChatGPT to generate multiple versions of reading comprehension questions tailored to different skill levels or simulate historical dialogues in social studies lessons. ChatGPT also supports differentiated instruction and adaptive feedback, offering real-time explanations or prompts suited to individual learner needs (Qadir). Students who struggle with writing or comprehension can receive instant scaffolding, while advanced learners can engage in exploratory questioning or critical debate with the model (Zhai). These features enhance personalized learning pathways and make formative feedback more timely and learner-responsive. In language learning and writing instruction, ChatGPT functions as a conversational partner, writing coach, and grammar checker. Several studies have documented its use in English as a Second Language (ESL) settings to support sentence formation, vocabulary acquisition, and pronunciation modelling (Kim, Kwon and Cho; Nget et al.). Students can practice dialogues, request alternative word choices, or receive feedback on coherence and tone, helping bridge the gap between passive learning and active production. Additionally, the model is increasingly being integrated into real-time tutoring, where learners use it to understand complex problems in mathematics, science, or humanities by prompting for step-by-step explanations (Smutny and Schreiberova). In higher education, ChatGPT is being tested as a study companion, helping university students summarize readings, draft research proposals, or prepare for debates.

2.3 Pedagogical benefits and innovations

The literature highlights several transformative pedagogical benefits resulting from the integration of ChatGPT. First, learner autonomy, curiosity, and critical questioning are amplified when students interact with generative AI tools. Rather than passively consuming content, learners engage with the model to seek clarification, generate hypotheses, or explore diverse perspectives, thus developing metacognitive and inquiry-driven habits (Dwivedi et al.). In flipped or blended classrooms, ChatGPT can serve as a pre-class resource that stimulates curiosity and allows for deeper in-class dialogue. Second, ChatGPT promotes inclusive education by addressing the diverse needs of learners, including those with disabilities, language barriers, or low academic confidence. Its text-to-speech integration, multilingual output, and low-pressure interface create accessible pathways for learners who may otherwise struggle with conventional instruction (Yadav et al.). Third, as an AI co-teacher and writing facilitator, ChatGPT assists educators in co-constructing assignments, rubrics, and feedback protocols. Some teachers use ChatGPT to generate draft lesson reflections or suggest

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alternative strategies for classroom management. For students, it acts as a brainstorming partner, helping them structure essays, explore counterarguments, or clarify complex ideas, thereby reducing cognitive load and enhancing fluency (Fikri; Kohnke, Moorhouse, and Zou).

2.4 Limitations and risks

Despite its benefits, the literature also warns of several limitations and ethical concerns associated with the widespread use of ChatGPT in educational contexts. Over-reliance on AI tools may lead to a reduction in deep thinking, as students may come to treat the model as a shortcut for completing assignments or generating answers without engaging in critical reflection. This "answer-machine" mentality can erode the development of independent problem-solving skills, particularly if not scaffolded by educators (Jeyaraman et al.). Misinformation is another concern, as ChatGPT occasionally produces plausibly sounding but inaccurate or outdated content, a phenomenon referred to as "hallucination" in AI research. (Bender et al.). Without adequate AI literacy, students may struggle to evaluate the credibility of AI-generated content, leading to epistemological confusion. The rise in academic dishonesty is particularly alarming. Teachers have reported an increase in instances of students submitting AI-generated essays or using ChatGPT during closed-book assessments. (Cotton, Cotton and Shipway). Institutions are now scrambling to develop detection tools, update academic integrity policies, and integrate AI literacy into student codes of conduct. Cultural resistance and uneven digital competence further complicate implementation. In some contexts, educators express discomfort with delegating instructional tasks to a machine or perceive AI as undermining the teacher's authority. (Huot and Em "Effective Strategies of English Teaching in Cambodia's Underserved Communities: Bridging Digital Divide to Access Education Quality."). Moreover, digital inequity, especially in low-resource settings, means that the benefits of AI integration are not evenly distributed, reinforcing existing educational divides as depicted in Table 1.

Table 1. Pedagogical applications, benefits, and risks of ChatGPT in global classrooms

Pedagogical Area	Applications of ChatGPT	Documented Benefits	Risks and Limitations
Curriculum Design & Instruction	- Co-generation of lesson plans - Scaffolding questions and examples	- Enhances teacher productivity - Supports curriculum responsiveness	- Over-reliance on AI-generated templates - Potential misalignment with local curricular goals

Pedagogical Area	Applications of ChatGPT	Documented Benefits	Risks and Limitations
Personalized Learning	- Differentiated instruction - Real-time adaptive feedback	- Increases learner autonomy - Encourages critical thinking	- Reduced deep cognitive engagement if not guided - Risk of shallow content understanding
Language & Writing Support	- Grammar/syntax checking - Essay structuring assistance - Dialogue simulation	- Boosts student confidence - Improves fluency and vocabulary acquisition	- Plagiarism and academic dishonesty - Hinders the development of original thinking
Tutoring & Study Support	- Q&A support - Explaining complex concepts - Step-by-step math and science guidance	- Enables low-stress learning environments - Promotes student agency	- Risk of misinformation ("hallucination") - Lack of contextual nuance in specific responses
Inclusion & Accessibility	- Text-to-speech conversion - Multilingual support	- Aids low-performing students - Inclusive for learners with disabilities	- The digital divide excludes rural and under-resourced communities - Inconsistent access to devices

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Pedagogical Area	Applications of ChatGPT	Documented Benefits	Risks and Limitations
Teacher Professional Development	- Resource generation - Reflective practice with AI feedback	- Supports novice educators - Encourages innovation in instructional design	- Limited AI training in teacher education - Cultural resistance in hierarchical teaching systems
Assessment & Feedback	- Drafting rubrics - Peer review simulation - Instant formative feedback	- Reduces teacher grading workload - Improves feedback timeliness	- Lack of transparency in AI scoring logic - Ethical concerns on fairness and accountability

III. Methodology of Review: Scope and Analytical Lens

3.1 Review type

This paper employs a narrative integrative review methodology, aiming to synthesize diverse sources of literature that examine the pedagogical impact of ChatGPT and generative AI technologies in educational settings. The narrative integrative approach is particularly suitable for capturing both empirical and conceptual insights across multiple disciplines, education, technology, linguistics, and digital pedagogy, while enabling an in-depth contextualization of global trends within Cambodia's unique educational environment. (Whittemore and Knafl; Torraco). Unlike systematic reviews, which require strict methodological uniformity, the integrative design allows for greater flexibility in synthesizing heterogeneous sources, such as case studies, policy documents, practitioner reports, and theoretical papers, with an emphasis on extracting practical and pedagogical implications. This approach also aligns with the review's goal of providing actionable insights for education policymakers, teacher educators, and school leaders.

3.2 Data sources and selection criteria

This evaluation draws upon literature published between January 2020 and May 2025, aligning with the global rise and integration of ChatGPT into educational discourse following its public launch by OpenAI in late 2022. The data collection process involved an extensive search across four major academic and institutional databases: Scopus, ERIC (Education Resources Information Centre), Web of Science, and Google Scholar, the latter of which was used to access supplementary grey literature and working papers. A Boolean search strategy was employed using combinations of the keywords: "ChatGPT," "generative AI," "pedagogical innovation,"

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"digital learning," and "Cambodia." To ensure relevance and quality, a set of inclusion criteria was established. This included peer-reviewed journal articles that focused explicitly on the use of ChatGPT or similar generative AI tools within educational contexts. It also encompassed reports and white papers from reputable international organizations such as UNESCO and the OECD, particularly those with a pedagogical emphasis on AI. Furthermore, policy documents and strategic plans related to digital education, especially those issued by the Cambodian MoEYS, were considered relevant. Conceptual and theoretical works that linked ChatGPT to frameworks such as cognitive learning models, digital pedagogy, or educational equity were also included. Exclusion criteria were clearly defined to maintain focus and ensure consistency throughout the study. Literature published prior to 2022, or materials that did not directly involve ChatGPT or relevant generative AI tools, were omitted. Additionally, non-scholarly sources such as blogs, commercial opinion articles, and technical AI development papers without pedagogical relevance were excluded. Studies concentrating solely on corporate training or AI applications in non-educational domains were also removed from the dataset. A total of 75 sources were initially screened. After reviewing titles and abstracts, 53 were selected for full-text analysis, from which 42 were ultimately retained for final synthesis based on their conceptual clarity, contextual relevance, and scholarly rigor.

3.3 Thematic coding approach

To ensure analytical depth and coherence, a thematic coding approach was applied to synthesize the selected literature. The coding process followed Braun and Clarke The six-phase method of thematic analysis involves familiarization with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and finally producing the report. This manual coding approach allowed for interpretive flexibility while maintaining a structured analytical framework. Four overarching thematic categories guided the review process; the first theme, Instructional Innovation, focused on how ChatGPT contributes to novel pedagogical practices, such as co-designing lessons, automating feedback, and supporting inquiry-based learning. The second category, Learner Engagement, captured insights into how students interact with AI tools, including aspects of motivation, autonomy, and metacognitive development. The third theme, Cognitive Support, examined the role of ChatGPT in facilitating critical thinking, problem-solving, knowledge acquisition, and language learning. The fourth and final category, Implementation Feasibility, explored practical considerations such as teacher readiness, technological infrastructure, ethical challenges, and cultural compatibility. As the review progressed, coding categories were refined to accommodate emerging subthemes, including distinctions between AI as a passive tool versus an active co-teacher, and the varying impacts of ChatGPT across high-resource and low-resource educational settings. This thematic structure enabled a grounded yet interpretive synthesis of diverse global insights, offering actionable implications for Cambodia's education system.

3.4 Limitations

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Despite the comprehensive scope of the review, several limitations must be acknowledged. A primary limitation is the scarcity of peer-reviewed research specific to Cambodia, particularly studies that empirically examine the integration of ChatGPT into local classrooms. Consequently, much of the contextual analysis relied on deductive inferences drawn from global literature and regional counterparts such as Vietnam, Thailand, and Indonesia. Another limitation concerns the predominant reliance on research from high-resource contexts, such as the United States, the United Kingdom, and technologically advanced regions of East Asia. These settings typically benefit from robust digital infrastructure, well-trained educators, and high student digital fluency, conditions that may not reflect the realities in Cambodian schools. This contextual asymmetry warrants caution when generalizing findings, underscoring the importance of conducting local pilot studies and generating evidence specific to Cambodia to inform practice. This summary is constrained by the rapidly evolving nature of generative AI technologies. As innovations in AI and ChatGPT continue to develop at an accelerated pace, much of the literature from 20204 and early 2025 may not fully capture longer-term implications, including impacts on student learning trajectories, classroom dynamics, or cultural perceptions of AI in education. Despite these challenges, the methodology provides a strong foundation for understanding the potential and limitations of integrating ChatGPT into Cambodian pedagogy, while also paving the way for further empirical and policy-focused research, as Table 2 illustrates.

Table 2. Methodology summary: review scope, sources, coding, and limitations

No.	Component	Details
1	Review Type	Narrative integrative review emphasizing practical and pedagogical insights from global literature.
2	Time Frame	2020–2025
3	Databases Searched	Scopus, ERIC, Web of Science, Google Scholar
4	Keywords Used	ChatGPT, pedagogical innovation, generative AI, digital learning, Cambodia
5	Inclusion Criteria	- Peer-reviewed articles - Education-focused reports - AI-in-pedagogy policy documents - Conceptual/theoretical studies
6	Exclusion Criteria	- Pre-2022 publications - Technical AI papers without educational relevance - Commercial blogs/opinion pieces

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No.	Component	Details
7	Final Sources Analysed	42 documents (selected from 75 initial records after screening)
8	Thematic Coding Categories	1. Instructional Innovation 2. Learner Engagement 3. Cognitive Support 4. Implementation Feasibility
9	Coding Methodology	Manual thematic analysis using Braun & Clarke's (2006) six-phase framework
10	Primary Limitations	- Limited empirical data from Cambodia - Overrepresentation of high-resource context studies - Rapid evolution of AI in the education field

IV. Findings: Global Pedagogical Patterns and Tools of Innovation

This section synthesizes international evidence on how ChatGPT is being adopted as a pedagogical tool across various educational systems. The findings are categorized into four thematic areas reflecting emerging patterns in teaching, learning, and inclusion. While the adoption of ChatGPT showcases transformative potential in enhancing instructional practices, fostering learner-centred models, and supporting personalized education, it also presents notable risks that require ethical and pedagogical safeguards.

One of the most widely documented uses of ChatGPT is its role as an instructional partner that aids educators in streamlining content creation, enhancing engagement, and increasing instructional efficiency. Teachers worldwide have integrated ChatGPT into lesson planning, using it to generate tailored teaching materials, quiz items, and learning outcomes that align with curricular goals (Kasneci et al.). Educators utilize ChatGPT to create scaffolded prompts that differentiate instruction based on students' levels, learning styles, or cognitive demands. Additionally, ChatGPT supports the design of assessment rubrics and feedback forms that help educators provide timely and structured evaluations. This automation of routine planning tasks not only reduces teacher workload but also enhances curriculum responsiveness, enabling teachers to adapt lessons in response to emerging student needs or changing classroom dynamics. Evidence from blended learning contexts in Finland and South Korea, for example, highlights how ChatGPT increased teacher productivity by enabling rapid revision of content aligned with real-time feedback and

performance data (Dwivedi et al.). The rise of ChatGPT aligns with the global shift toward learner-centred pedagogies, where the teacher acts as a facilitator rather than a sole source of knowledge. ChatGPT plays a critical role in fostering inquiry-based learning by prompting dialogic questioning, encouraging students to engage in sustained exploration of complex topics. In several higher education classrooms, students have utilized ChatGPT as a partner in brainstorming and exploratory learning, prompting it to clarify ideas, generate multiple perspectives, and provide evidence to support emerging arguments (Kohnke, Moorhouse, et al.). The model also supports hypothesis formation in STEM and social sciences by helping students articulate problem statements, formulate research questions, and engage in scenario-based learning simulations. For example, in flipped classrooms in Singapore, ChatGPT was utilized as a pre-class tool to simulate debates and stimulate reflective dialogue in preparation for live group discussions (Zhai). These practices shift students away from rote memorization and toward a more constructivist learning process, where knowledge is co-created through interaction, iteration, and guided self-discovery.

ChatGPT has demonstrated promise in promoting personalized and inclusive education, especially for learners with linguistic, cognitive, or emotional challenges. Its ability to respond in real-time and adjust explanations according to learner input makes it a powerful tool for differentiated learning. For instance, students with lower reading proficiency or limited vocabulary can prompt ChatGPT to rephrase or simplify content without the stigma often associated with seeking human assistance. (Yadav et al.). Moreover, ChatGPT enhances accessibility for learners with disabilities by integrating with screen readers, offering alternative input and output modes, and providing on-demand, low-pressure learning assistance. Several pilot programs in inclusive classrooms in Canada and the Netherlands have reported that learners with attention deficits or anxiety benefit from ChatGPT's low-stakes interaction model, which reduces stress while reinforcing content. (Smutny and Schreiberova). Additionally, its capacity for multilingual support allows non-native speakers to learn in both their native language and target language, making it a flexible resource in linguistically diverse classrooms.

Despite the benefits, the pedagogical use of ChatGPT is not without significant risks. A growing concern is the emergence of an "AI-as-answer-machine" culture, where students engage with ChatGPT not to think deeply but to receive quick answers or have tasks completed. This reliance on templates over critical engagement risks undermining cognitive development, particularly in foundational educational stages (Jeyaraman et al.). Plagiarism and academic dishonesty have also been exacerbated by ChatGPT's ability to generate coherent essays, research summaries, and code scripts. Teachers and institutions have struggled to keep pace with the scale of potential misuse, often lacking tools to detect AI-generated content or policies to govern its responsible use (Cotton, Cotton, and Shipway). Without structured guidance, students may misuse ChatGPT to shortcut learning processes rather than to augment understanding. Furthermore, the lack of teacher supervision and integration in AI use can lead to superficial engagement, where students interact with the tool in isolation, without the benefit of pedagogical framing or reflective scaffolding. This risk is amplified in settings where digital literacy

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is uneven or where educators themselves lack sufficient training in AI-supported instruction. If left unchecked, this pattern could exacerbate inequities and diminish the quality of meaningful learning experiences as reflected in Table 3.

Table 3. Summary of global pedagogical patterns in ChatGPT integration

Thematic Area	**Key Applications**	**Documented Benefits**	**Risks and Limitations**
ChatGPT as an Instructional Partner	- Lesson planning - Prompt scaffolding - Assessment rubric design	- Enhances teacher productivity - Improves curriculum responsiveness	- Risk of over-automation - Potential mismatch with national curriculum standards
Learner-Centred & Inquiry Practices	- Dialogic questioning - Brainstorming prompts - Hypothesis generation and reflective dialogue	- Promotes active learning - Encourages critical thinking and curiosity	- May reduce depth without pedagogical framing - Risk of dependency on AI to initiate inquiry
Personalized & Inclusive Pathways	- Multilingual support - Differentiated learning assistance - On-demand feedback for low-confidence learners	- Supports struggling learners - Increases accessibility and inclusion	- Access inequity in low-tech settings - Inconsistent outcomes without guided integration

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Thematic Area	Key Applications	Documented Benefits	Risks and Limitations
Risks of Pedagogical Misuse	- Overuse for answer retrieval - AI-generated essay completion - Unguided independent use	- Speeds up task execution (if used ethically) - Useful for initial drafts or brainstorming	- Academic dishonesty - Superficial learning - Erosion of critical and independent thinking skills

V. Cambodian Context: Challenges and Opportunities for Adoption

The integration of ChatGPT and generative AI technologies into Cambodian education presents a complex landscape of both promise and constraint. While MoEYS has demonstrated a clear commitment to digital transformation through its 2020–2028 ICTs policy framework, the realities of infrastructure, teacher preparedness, policy coherence, and cultural compatibility pose significant hurdles to implementation. This section contextualizes the global pedagogical insights reviewed earlier within Cambodia's educational ecosystem, highlighting key barriers and possible entry points for innovation.

5.1 Infrastructure and digital equity

A fundamental challenge in the Cambodian context is the lack of equitable access to digital infrastructure, particularly in rural and underserved communities. Despite national efforts to expand internet connectivity and ICT infrastructure, many schools outside major urban centres continue to struggle with low device penetration, intermittent electricity, and limited bandwidth (UNDP). A recent survey by UNESCO Indicated that only 35% of rural secondary schools have stable internet connections, and fewer than 40% of students report access to a personal learning device such as a tablet or laptop. Moreover, a sharp divide exists between public and private educational institutions. Elite urban schools, often supported by international partnerships or NGOs, are better equipped to pilot EdTech tools, while most public schools lack basic digital resources. This disparity risks reinforcing existing educational inequalities if ChatGPT and similar AI tools are introduced without a strong equity-focused policy framework. Successful adoption, therefore, will depend not only on technological investment but also on systemic strategies to ensure inclusive access across regions and socioeconomic strata.

5.2 Teacher capacity and innovation culture

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Another significant obstacle is the limited integration of AI and EdTech training in pre-service and in-service teacher education programs. While digital literacy modules have been introduced into some teacher training institutes, they often focus on basic ICT usage (e.g., PowerPoint or Zoom) rather than advanced digital pedagogy or AI-enabled instruction. (Janse van Rensburg). Consequently, most educators remain unfamiliar with how tools like ChatGPT can be ethically and effectively embedded into lesson design, formative assessment, or student-led inquiry. Furthermore, Cambodia's educational culture continues to be shaped by hierarchical classroom norms, where knowledge is transmitted from teacher to student in a largely top-down manner. This tradition may foster resistance to student-centred models enabled by AI, which require teachers to adopt more facilitative and flexible roles. Without robust professional development programs that emphasize participatory digital pedagogy and reflective practice, there is a risk that generative AI tools will either be underutilized or misapplied. Nonetheless, there are emerging pockets of innovation, particularly in higher education institutions and urban experimental schools, where teachers are beginning to explore ChatGPT for language teaching, academic writing assistance, and instructional planning. Scaling these innovations will require institutional support, peer learning networks, and mentorship models to build teacher confidence and capacity.

5.3 Policy gaps and curriculum rigidities

At the policy level, Cambodia faces significant gaps in its regulatory frameworks and curricular alignment for integrating AI in education. The current national curriculum does not yet incorporate specific learning outcomes or competencies related to AI literacy, algorithmic thinking, or responsible digital citizenship. This absence creates ambiguity about how tools like ChatGPT can be meaningfully aligned with existing instructional goals and assessment frameworks. (MoEYS). Additionally, there is a lack of clarity regarding the legal and ethical implications of using AI in educational settings, particularly in terms of privacy, academic integrity, and the use of automated feedback. Unlike countries such as Singapore and South Korea, which have developed national AI-in-education strategies, Cambodia has yet to establish formal guidelines to govern the use of generative AI tools in classrooms, exams, and administrative systems. This regulatory vacuum may result in uncoordinated experimentation, inconsistent implementation, and public mistrust if not addressed through a structured national strategy. Furthermore, the rigidity of the national curriculum may impede the integration of flexible, inquiry-based AI-supported learning models. Teachers often express that they are under pressure to "cover the syllabus," which limits the opportunity to experiment with new pedagogical approaches or tools. Revising the curriculum to allow for adaptive learning pathways and digital competencies will be essential if ChatGPT is to serve as a catalyst for pedagogical innovation rather than an add-on tool.

In the long run, the effective deployment of ChatGPT in Cambodia must take into account the country's deep-seated socio-cultural and linguistic factors. A major technical limitation is ChatGPT's limited proficiency in the Khmer language, which restricts its accessibility for learners and teachers who are not fluent in English or

French. Although OpenAI continues to expand its multilingual capabilities, Khmer remains an underrepresented language in AI training datasets, resulting in inconsistent translation quality, cultural misalignment, and reduced usability for native speakers. Additionally, cultural perceptions of authority and trust in educational settings may influence how AI is perceived. Cambodian society generally places a high value on the authority of teachers and the moral dimensions of knowledge. As such, delegating aspects of instruction or assessment to an algorithm may be viewed with skepticism or even disapproval, particularly if AI is seen as undermining the relational and ethical fabric of education. Efforts to introduce ChatGPT must therefore be accompanied by community engagement and teacher-led framing, emphasizing the tool's role as a supplement, not a substitute, for human pedagogy. However, Cambodia's deep-rooted Buddhist ethical tradition and increasing openness to digital tools among youth also offer potential for developing contextually sensitive AI education models. By framing ChatGPT as a means of cultivating self-reflection, questioning, and compassion within learning, it may be possible to harmonize the tool with local values and educational goals as indicated in Table 4.

Table 4. Key challenges and opportunities for ChatGPT adoption in Cambodian education

Thematic Area	**Key Challenges**	**Emerging Opportunities**
Infrastructure and Digital Equity	- Low device availability and poor internet connectivity in rural areas - Urban-rural digital divide - Uneven access between public and private schools	- Government ICT strategy (2020–2028) - Growing NGO and donor support for EdTech initiatives
Teacher Capacity and Innovation Culture	- Limited AI/EdTech content in teacher training programs - Resistance to shifting away from traditional, teacher-centred models	- Early adoption in higher education - Opportunity for professional development and peer mentoring
Policy Gaps and Curriculum Rigidities	- Absence of AI-specific policies and curriculum outcomes - Lack of ethical guidelines for AI in education - Pressure to cover the rigid syllabus	- MoEYS' digital policy provides a starting point - Opportunity to integrate AI literacy and digital citizenship

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Thematic Area	Key Challenges	Emerging Opportunities
Socio-cultural and Linguistic Considerations	- ChatGPT has limited Khmer language support - Cultural concerns around trust, teacher authority, and AI use	- Strong Buddhist learning values may support reflective AI use - Rising digital curiosity among Cambodian youth

VI. Discussion: Localizing Pedagogical Innovation through AI

Integrating AI tools, such as ChatGPT, into Cambodian classrooms requires a culturally sensitive approach. Rather than emulating Western models, Cambodia should adapt AI to align with its national priorities, institutional capacities, and cultural values. This involves tailoring AI functionalities, such as dialogue, feedback, and ideation, to support Khmer educational contexts. For instance, inquiry-based learning can incorporate scenarios that reflect Khmer history, Buddhist ethics, or rural livelihoods, thereby enhancing both cognitive engagement and cultural relevance.

Empowering teachers as active designers of AI applications is crucial. By creating context-specific ChatGPT activities, like crafting prompts or developing Khmer language writing tasks, educators can enhance pedagogical relevance and foster professional agency. This aligns with constructivist teaching philosophies, positioning educators as co-creators of learning experiences.

Establishing a supportive institutional ecosystem is essential for successful localization. Teacher training institutes and model high schools can serve as innovation labs to pilot the integration of ChatGPT, allowing educators to experiment with lesson designs and teaching strategies in a low-risk environment. Collaboration among stakeholders, including the Ministry of Education, NGOs, EdTech firms, universities, and international donors, is crucial to establishing a collaborative AI-in-education ecosystem. For example, partnerships with organizations like the Open Institute and CARE Cambodia can support the adaptation of ChatGPT for Khmer literacy. At the same time, global partners such as UNESCO or UNICEF may fund research into the inclusive use of AI among marginalized learners. As AI becomes more accessible, fostering ethical awareness and digital responsibility is imperative. Integrating digital citizenship curricula that teach students to question, verify, and reflect on AI outputs can promote responsible use. Customized training modules for teachers and students should address data privacy, authorship, bias detection, and ethical prompt engineering. Implementing reflective journals or ethics circles can further encourage students to engage thoughtfully with AI tools.

At last, ChatGPT offers an opportunity to transform Cambodian classrooms from rote memorization to reflective and critical learning environments. With careful design,

ISSN 2349-4948

it can function as a conversational agent that encourages Socratic questioning and research-based inquiry. Teachers can model metacognitive thinking, guiding students to ask practical questions and revise written arguments based on feedback. In writing-based subjects, ChatGPT can provide iterative feedback, helping students strengthen their work through structured interaction. In project-based learning, it can assist in brainstorming and presenting ideas while managing cognitive load. This approach aligns with Cambodia's education reform priorities, emphasizing holistic development, creativity, and critical thinking as essential components of citizenship.

VII. Conclusion and Recommendations

The rapid advancement of generative artificial intelligence, particularly ChatGPT, has ushered in a paradigm shift in how teaching and learning are conceptualized, delivered, and experienced globally. This academic work has explored the pedagogical potential of ChatGPT through a global synthesis of emerging practices and theoretical frameworks, contextualizing their relevance within Cambodia's evolving educational ecosystem. As Cambodia stands at the intersection of digital transformation and educational reform, the thoughtful integration of ChatGPT presents a unique opportunity to modernize instruction, promote student-centered learning, and foster digital citizenship, provided it is grounded in equity, ethics, and cultural alignment.

The findings from this review affirm that ChatGPT holds catalytic potential for pedagogical innovation in Cambodia, particularly in areas such as instructional design, feedback automation, inclusive learning, and inquiry-based practices. However, the benefits of such tools are not automatically realized. Their impact is mediated by a range of contextual factors, including digital infrastructure, teacher capacity, and curriculum flexibility. Cambodia's education system, while increasingly open to EdTech solutions, must adopt strategic, culturally adaptive approaches to ensure that AI tools, such as ChatGPT, are integrated meaningfully and ethically. Success will hinge on the ability of national and local stakeholders to create an enabling environment that includes not only hardware and connectivity but also professional development, policy reform, and community engagement.

To ensure that ChatGPT's integration into Cambodian education is both sustainable and inclusive, this review provides recommendations across policy, practice, and research domains. At the policy level, MoEYS should develop a national AI-in-Education strategy that includes ethical guidelines, data privacy protections, and equity-focused measures. Embedding AI literacy benchmarks into the national curriculum will help equip both teachers and students with the essential digital competencies they need. Targeted investments should also be made to reduce the digital divide, particularly in rural areas, through infrastructure upgrades and public-private partnerships. In terms of practice, establishing teacher innovation hubs in universities and training institutes is crucial. These hubs would enable educators to collaboratively explore the use of ChatGPT in lesson design and curriculum adaptation, ensuring alignment with the Khmer context. Teachers should be empowered to lead participatory curriculum development, particularly in subjects such as digital literacy, civic education, and language arts. Additionally, schools should implement responsible

AI usage protocols, such as ethical prompting, academic honesty policies, and reflective student activities. On the research front, it is vital to conduct localized pilot studies to evaluate ChatGPT's impact on teaching and learning across diverse settings in Cambodia. These should be complemented by participatory design research involving educators, students, and technologists to co-create Khmer-compatible AI tools. Cambodia should also engage in regional collaboration with ASEAN to share innovations, build multilingual datasets, and contribute to a Southeast Asian framework for the ethical use of AI in education.

Moving forward, Cambodia should adopt a long-term research and development strategy to support the meaningful integration of AI. Longitudinal studies are necessary to evaluate the broader impacts of AI tools like ChatGPT, not only on academic performance but also on digital ethics, critical thinking, and learner identity. Equally important is the development of Khmer-language natural language processing (NLP) capabilities to ensure that AI tools are accessible and culturally relevant to the Khmer community. This effort will require national investment in linguistic research and regional cooperation with AI experts across Southeast Asia.

Finally, Cambodia's active participation in cross-ASEAN initiatives can help shape shared ethical standards, foster EdTech diplomacy, and enhance its role as a regional leader in AI-driven education. By embedding ChatGPT within its broader education reform agenda, Cambodia can cultivate a digitally empowered generation of learners and educators who are both globally informed and locally grounded.

Author Contributions: All authors contributed equally to this work. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data sharing policy does not apply to this article.

Conflicts of Interest: The authors declare that they have no conflicts of interest.

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